Encourage_Power

Overview and Directions for Running the Shiny R Dashboard Program

November 2023

Peter Z. Schochet (pschochet@mathematica-mpr.com)

Random encouragement designs evaluate treatments that aim to increase participation in a program or activity. These experiments can also assess the effects of participation on longer-term outcomes by estimating the (CACE) complier average causal effect parameter that pertains to those who comply with their treatment assignments. *Encourage_Power* is a Shiny R dashboard that performs power calculations for these encouragement designs using the methods in Schochet (*Journal of Educational and Behavioral Statistics*, 2024). The calculations are conducted for commonly used experimental designs—including nonclustered, clustered, and random block designs—and allow for the inclusion of model covariates to improve precision. The inputs for the power analysis can be entered flexibly into the dashboard.

Encourage_Power.R can be run in R (Version 4.0 or later) using standard methods for running R programs (such as using R Studio). Before using the dashboard, you will need to download the following six commonly used R packages from the official R repository (CRAN): shiny, shinydashboard, ggplot2, kableExtra, ggtext, and scales. These packages can be installed, for example, using the install.packages("ggplot2") command, and similarly for the other five packages. If not installed, you may be asked if you want them installed the first time you run the program.
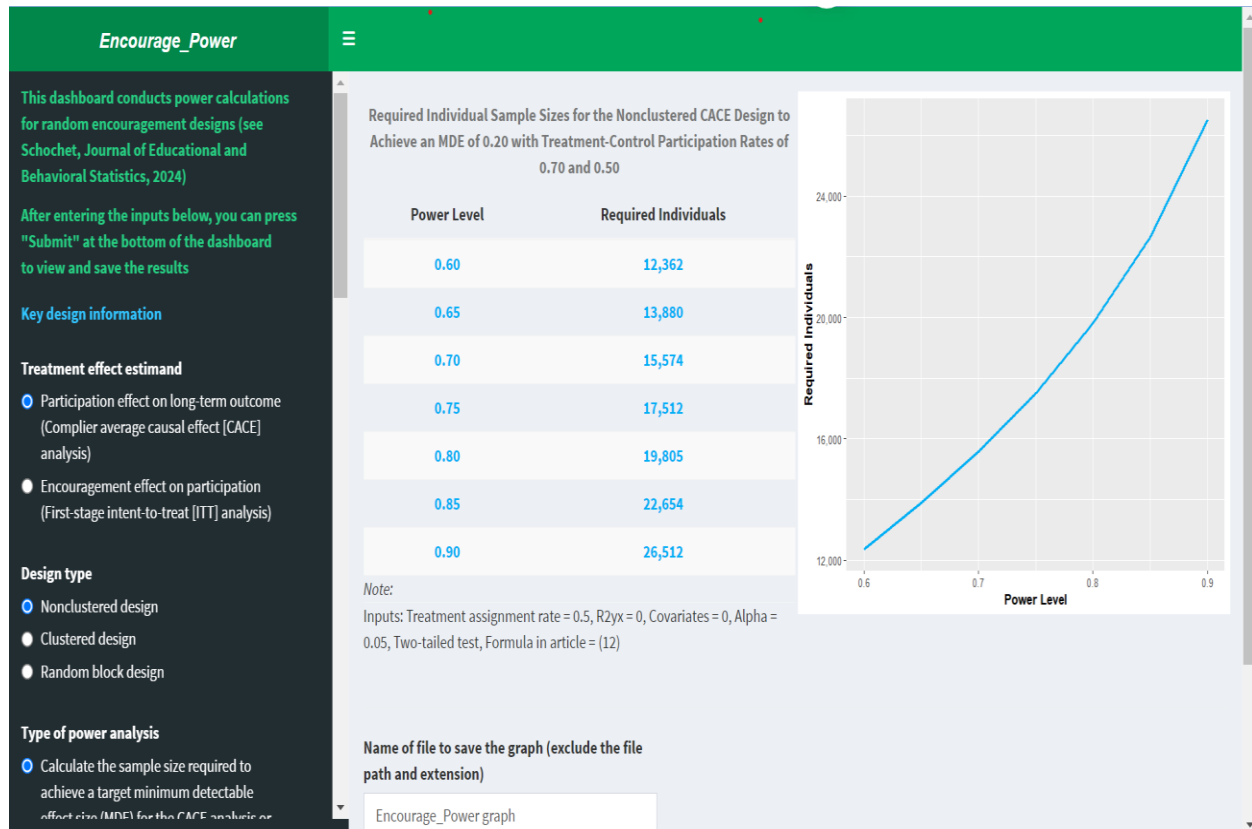
When the Encourage_Power.R program is run, the *Encourage_Power* dashboard will open and you can then enter inputs for your design in the sidebar panel. The dashboard displays default inputs that you should tailor to your design. After pressing the Submit button at the bottom of the sidebar, the program will then produce a table and graph showing the power analysis results (see two output examples on the following pages). The graph can then be saved to a .pdf or .png file. The program will check for errors and describe them. You can produce new results in the same session by updating your inputs.

A few notes on the program:

1. The program can conduct two types of power analyses:

    a. **The required sample size to achieve a given treatment effect—in effect size units for the CACE analysis and in percentage points for the participation rate analysis.** This is the preferred analysis as if yields the most stable results.

    b. **The minimum detectable treatment effect that can be achieved for a given sample size.** These calculations are conducted for the CACE analysis only but not for the participation rate analysis.

2. For the CACE analysis, the sample size calculations can be performed using one of three formulas discussed in the Schochet (2024) article. The default formula is Eq. (12) in the article, but Eqs. (11) or (13) can also be specified. Eq. (12) is preferred to Eq. (11) if the treatment effect is expected to be very large, but the two formulas will produce similar results otherwise. Eq. (13) provides upper bound estimates that tend to be overly conservative.

Two output examples from *Encourage_Power*

1. Calculating the sample size required to achieve a target minimum detectable effect size (MDE)

Encourage_Power

This dashboard conducts power calculations for random encouragement designs (see Schochet, Journal of Educational and Behavioral Statistics, 2024)

After entering the inputs below, you can press "Submit" at the bottom of the dashboard to view and save the results

Key design information

Treatment effect estimand

○ Participation effect on long-term outcome (Complier average causal effect [CACE] analysis)

● Encouragement effect on participation (First-stage intent-to-treat [ITT] analysis)

Design type

○ Nonclustered design
● Clustered design
● Random block design

Type of power analysis

○ Calculate the sample size required to achieve a target minimum detectable effect size (MDE) for the CACE analysis or

Required Individual Sample Sizes for the Nonclustered CACE Design to Achieve an MDE of 0.20 with Treatment-Control Participation Rates of 0.70 and 0.50

Power Level	Required Individuals
0.60	12,362
0.65	13,880
0.70	15,574
0.75	17,512
0.80	19,805
0.85	22,654
0.90	26,512

Note:

Inputs: Treatment assignment rate = 0.5, R2yx = 0, Covariates = 0, Alpha = 0.05, Two-tailed test, Formula in article = (12)

Name of file to save the graph (exclude the file path and extension)

Encourage_Power graph

2. Calculating the MDE for a given sample size

Encourage_Power

This dashboard conducts power calculations for random encouragement designs (see Schochet, Journal of Educational and Behavioral Statistics, 2024)

After entering the inputs below, you can press "Submit" at the bottom of the dashboard to view and save the results

Key design information

Treatment effect estimand

○ Participation effect on long-term outcome (Complier average causal effect [CACE] analysis)

● Encouragement effect on participation (First-stage intent-to-treat [ITT] analysis)

Design type

● Nonclustered design
○ Clustered design
● Random block design

Type of power analysis

● Calculate the sample size required to achieve a target minimum detectable effect size (MDE) for the CACE analysis or

MDE Results for the Clustered CACE Design with 20 Clusters, 50 Individuals per Cluster, and Treatment-Control Participation Rates of 0.70 and 0.50

Power Level	MDE Value
0.60	1.85
0.65	2.06
0.70	2.31
0.75	2.65
0.80	3.16
0.85	4.12
0.90	7.86

Note:

Inputs: Treatment assignment rate = 0.5, R2yx = 0, Covariates = 0, Design effect = 3.45, ICC of mean outcomes = 0.05, Alpha = 0.05, Two-tailed test, Formula in article = (12)

Name of file to save the graph (exclude the file path and extension)